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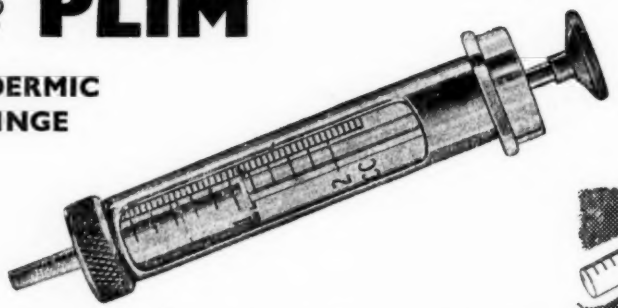

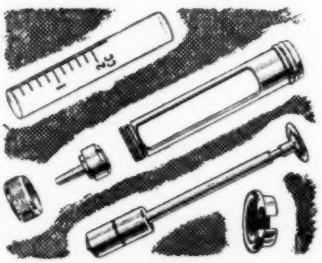

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The Diagnosis of *Vibrio fetus* Infection in Bulls

BY

W. J. BRINLEY MORGAN, D. R. MELROSE and D. L. STEWART
Ministry of Agriculture, Fisheries and Food, Reading Cattle Breeding Centre

SUMMARY.—1. *Fifty-two bulls have been examined for evidence of* V. fetus *infection by culturing semen and preputial samples and by culturing samples from the genital organs of heifers after insemination with the semen of these bulls.*

2. V. fetus *was not isolated from semen or preputial samples from any of the bulls examined although it was later shown, by test mating, that* 16 *were infected with* V. fetus. *Catalase negative and* H_2S *positive vibrios were frequently isolated both from infected and non-infected bulls. In a series of* 28 *bulls examined, catalase negative vibrios were isolated from the prepuce of* 22 *and from the semen of* 15. *Of a further* 24 *bulls where semen samples only were cultured, catalase negative vibrios were isolated from* 5. *An account is given of the morphological, cultural and biochemical properties of catalase negative vibrios. None of the catalase negative strains was agglutinated by stock sera for* V. fetus.

3. *In a preliminary investigation three out of* 12 *bulls were diagnosed as carriers of* V. fetus *by inseminating* 2 *to* 4 *heifers with the semen of each bull. The diagnosis was based on the development of vaginal mucus agglutinins or on the recovery of* V. fetus *from oestrous mucus samples using blood agar plates. This method was, however, time consuming and expensive on heifers. Two of these three bulls had previously been shown to have significantly increased conception rates in routine artificial insemination by the addition of* 500μg *per ml. streptomycin to the semen diluent.*

4. *Seven heifers were inseminated with either semen or sheath washings from two known infected bulls and cultural examinations made on Thio blood agar of uterine biopsy and vaginal mucus samples for a period of* 7 *months after insemination. During this period,* 42 *per cent. of the uterine biopsy samples and* 55 *per cent. of the vaginal mucus samples were culturally positive for* V. fetus. *During the first* 4 *weeks of the infection,* 48 *per cent. of the uterine and* 70 *per cent. of the vaginal mucus samples were culturally positive for* V. fetus. *Five of the heifers gave positive reactions to the mucus agglutination test.*

5. *Finally,* 45 *bulls were examined for* V. fetus *infection by inseminating one heifer with the semen of each bull and culturing uterine biopsy and vaginal mucus samples on Thio blood agar plates during the first month after insemination. Thirteen bulls were diagnosed as being infected. Fifty per cent. of the uterine biopsy and* 90 *per cent. of the vaginal mucus samples were culturally positive for* V. fetus. *An account is also given of the morphological, cultural and biochemical properties of the strains of* V. fetus *isolated.*

The remaining 32 *bulls have since been examined on* 3 *occasions at* 6*-monthly intervals using one heifer per bull. In all cases they have been negative. Catalase negative vibrios have been isolated from a proportion of the heifers but the recovery rate was never high, usually being isolated only a few times from any particular animal.*

6. *It is concluded that at present, the most reliable method of diagnosis is to inseminate one heifer with the semen of each bull and to examine vaginal mucus culturally for* V. fetus.

THE addition of antibiotics to semen diluents is now extensively employed in routine artificial insemination practice. Many workers have shown, by split sample field trials, that the addition

of antibiotics to bull semen significantly increases the conception rates of some, but not all, bulls. Stewart, Melrose and Wilson (1951) postulated that the antibiotics enhanced the conception rates of certain bulls by their action on a specific organism directly affecting the fertility of the cow. Since then, Terpstra and Eisma (1951), Lawson and MacKinnon (1952), McEntee, Hughes and Gilman (1954) and Willett, Ohms, Frank, Bryner and Bartlett (1955) and others have shown that *Vibrio fetus* causes a temporary infertility in cattle. The disease is spread by the bull at coitus and by artificial insemination.

Adler (1952 and 1954) described a technique for the diagnosis of *V. fetus* infection in bulls by culturing biopsy material from the cervix and uterus of heifers inseminated with the semen of bulls, using only one heifer per bull. Cultural examinations using a semi-solid medium were made twice-weekly for three weeks after insemination and any negative heifers were subsequently reinseminated with the semen of another bull.

Direct cultural examinations of preputial and semen samples have not proved successful for diagnosis largely because of the presence of fast growing contaminating organisms in these sources. Thouvenot and Florent (1954) isolated and described an anaerobic vibrio—*Vibrio bubulus*—which was commonly found in the semen of bulls, and Bryner and Frank (1955) and Price, Poelma, and Faber (1955) divided bovine vibrios into two groups based on catalase and hydrogen sulphide production tests. All strains of *V. fetus* were catalase positive and did not produce hydrogen sulphide, whereas non-pathogenic vibrios did not produce catalase but produced abundant hydrogen sulphide. Hughes (1956) reported that 25 to 39 per cent. of semen samples from known infected bulls were culturally positive for *V. fetus* using a semi-solid medium for isolation, and he considered semen to be more satisfactory for isolation than preputial fluids. Sjollema (1952) reported that the isolation of *V. fetus* from prepuce and semen was possible but not reliable. Similar experience was reported by Frank and Bryner (1953). It follows, therefore, that to establish a positive diagnosis by direct cultural examination of the bull, the isolated vibrio must be shown to be *Vibrio fetus*. From the published reports, it appeared that *V. fetus* could be more readily isolated from the genital tract of an infected heifer than from either semen or preputial fluids of an infected bull.

The purpose of the initial investigation was to ascertain whether the specific agent mentioned by Stewart, *et al.* (1951), was in fact, *V. fetus*. It was further decided to examine various methods for the diagnosis of the disease in bulls. A preliminary report of this work has been published (Morgan, 1956). Details of the present investigation are described under the following headings:—

a. Diagnosis by direct cultural examination of semen and preputial samples.

b. Diagnosis by cultural examination of heifers following insemination with the semen of bulls.

a. *Diagnosis by Direct Cultural Examination of Semen and Preputial samples*

For this investigation, semen and preputial samples from 28 bulls at this Centre were examined culturally for *V. fetus*. It was not known at that time whether any of the bulls were, in fact, infected with *V. fetus*. In addition, semen samples only from a further 24 bulls from other sources were also examined culturally.

Preputial samples were taken by restraining the bulls in stocks and, after washing the preputial orifice, a small, sterile, ewe-type vaginascope was introduced into the prepuce and a sterile swab passed through the vaginascope into the posterior third of the prepuce where it was massaged from the outside. The semen samples for culture were collected in an artificial vagina. The media used for primary isolations and for the catalase and hydrogen sulphide production tests have already been described (Morgan, 1957). Each and every sample was seeded on 3 Thio blood agar plates and incubated at 37° C. for 6 days in an atmosphere containing 10 to 15 per cent. CO_2. Smears were made of all the plates and, whenever possible, pure cultures were obtained for typing the vibrios by the catalase and H_2S production tests. The results are recorded in Table I.

TABLE I

	No. of bulls examined	Source of sample	No. of samples examined	No. of samples yielding catalase negative vibrios	No. of bulls yielding catalase negative vibrios
Group I	28	Prepuce	118	50	22
		Semen	106	27	15
Group II	24	Semen	59	7	5

Vibrios could be isolated at almost every examination from certain bulls especially from preputial samples whereas, from other bulls, vibrios could only be isolated on one occasion. Both semen and preputial samples from certain bulls were constantly contaminated with *Pr. vulgaris* in spite of special precautions having been taken to get clean samples. Diphtheroids, micrococci and Escherichia species were the most common organisms isolated. *V. fetus* was not isolated from any of the samples, although it was later shown, by test mating, that 5 of the 28 bulls in the first group and 12 of the 24 in the second group were infected with *V. fetus*.

Morphological, Cultural and Biochemical characters of Vibrios isolated from Bulls. On primary isolation, the vibrio colonies were about 2 mm. in diameter, circular, smooth, opaque, greyish-white, homogenous with an entire edge. Often, the colonies had a greenish tinge with the medium similarly discoloured (fig. 1a). Colonies were easily emulsified and the cells very actively motile. In smears, the cells were gram-negative, 2 to 3 μ long and comma shaped (fig. 2a). Curved spiral forms were rare although, occasionally, two cells end to end were found.

FIG. 1a.—Bull semen cultured on Thio blood agar plates showing numerous colonies of catalase negative vibrios (a) and small white shiny colonies of micrococci.

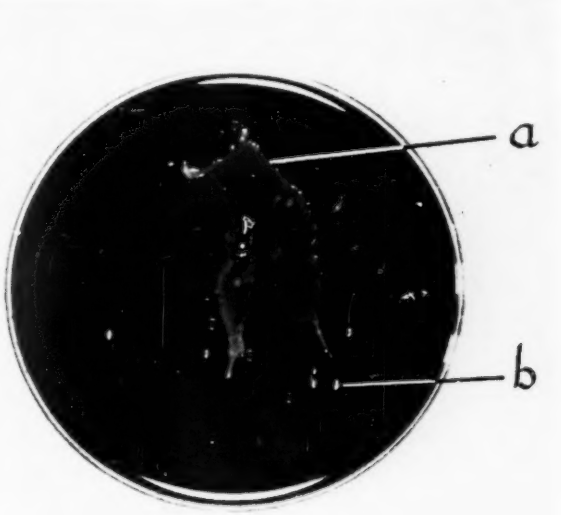

FIG. 1b.—Vaginal mucus from infected heifer cultured on Thio blood agar plate showing (a) grey confluent growth of *V. fetus*, (b) isolated colonies of *V. fetus*.

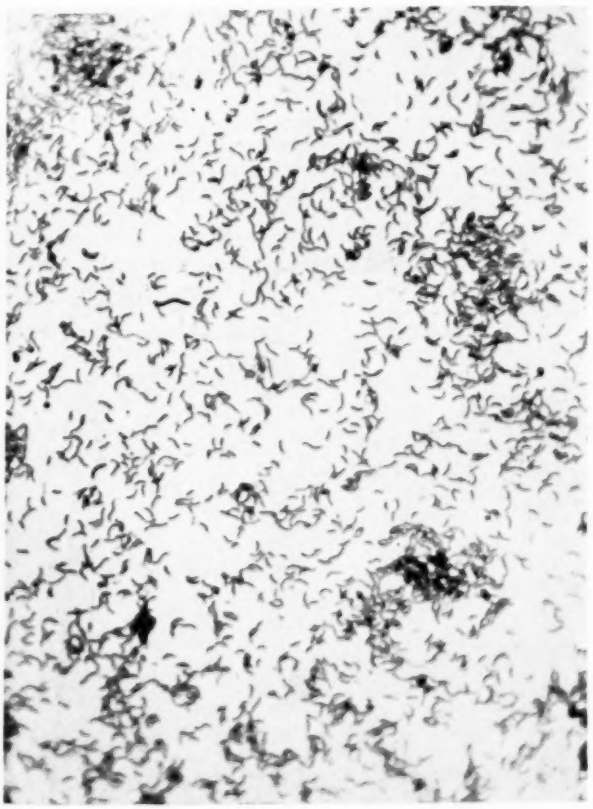

FIG. 2a.—Smear of catalase negative vibrios stained by Gram's method.

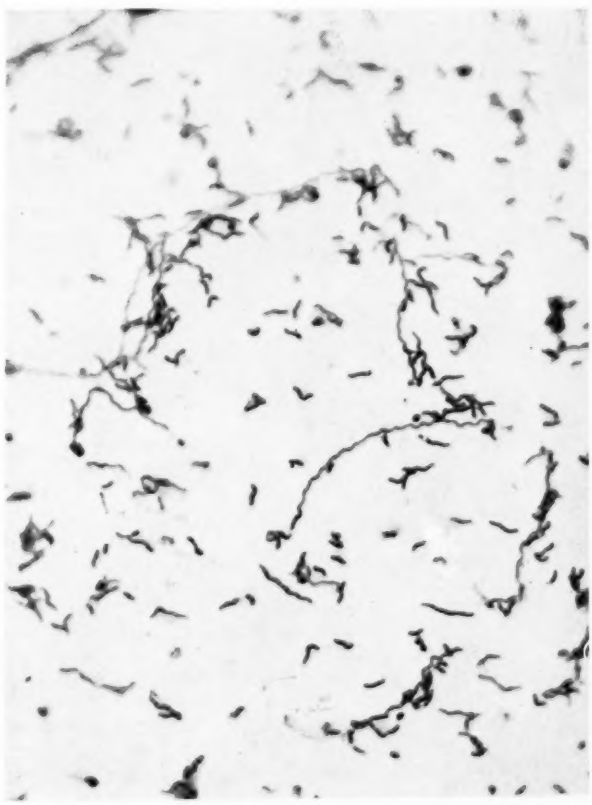

FIG. 2b.—Smear of *V. fetus* stained by Gram's method.

Twenty-six strains were obtained in pure culture—8 from preputial swabs and 18 from semen. All the strains were catalase negative, produced abundant hydrogen sulphide and reduced nitrates to nitrites. In Brewer's medium, growth only occurred between 30° and 39° C. and was obtained without the addition of CO_2 and characteristically occurred as a band about 2 to 4 mm. below the surface of the medium. This contrasted with the growth of *V. fetus* which grew on the surface of Brewer's medium, slowly spreading into its depth. On solid media, the catalase negative strains would not grow except in the presence of about 10 to 15 per cent. added CO_2; growth also occurred but was not improved under anaerobic conditions. Formolised suspensions were prepared against the catalase negative strains and agglutination tests made against sera for *V. fetus*. None of the catalase negative strains was agglutinated by *V. fetus* sera. Sera were prepared in rabbits against some of the catalase negative strains; these sera did not agglutinate suspensions of *V. fetus*. Preliminary results have shown the existence of at least three serological groups of catalase negative bovine vibrios.

b. *Diagnosis by Cultural Examination of Heifers following Insemination with the Semen of Bulls*

This was investigated in three stages.

In experiment 1, diagnosis was made by inseminating a number of maiden heifers with the semen of each bull and demonstrating specific agglutinins in samples of dioestrous mucus. Cultural examinations were made on samples of oestrous mucus only.

In experiment 2 are given the results of a pilot experiment designed to test the efficiency of the method of diagnosis described by Adler (1952). This entailed the insemination of only one heifer with the semen of each bull and a diagnosis, based on the recovery of the causal organism, could be made within a month of insemination.

Finally, in experiment 3 are given the results of the examination of a number of bulls based on the satisfactory results of Experiment 2.

Experiment 1. In this experiment, 2 to 4 heifers were inseminated with the semen of each of 12 bulls. The heifers, which were shown to be free of Vibriosis before insemination on the basis of the mucous agglutination tests and cultural examinations of oestrous mucus, had been obtained from herds free of *V. fetus* infection based on the mucous agglutination test of a proportion of the herd. As each heifer came into oestrus, samples of mucus were cultured on 10 per cent. horse blood agar plates using three plates per sample. At the same time, each heifer was inseminated with one ml. raw semen into the uterus and again with the same semen on the following day. Semen samples were also cultured on blood agar plates.

Vaginal mucous agglutination tests were also made regularly on the dioestrous mucus of all the heifers, and, as each heifer returned to oestrus, the mucus was again cultured on blood agar plates. This was continued for a period of 6 months. Once *V. fetus* was isolated from any of the heifers, they were then kept in isolation. The results are recorded in the following table:

TABLE II

Bull	No. of heifers used for insemination	No. of heifers giving: Positive cultures of *V. fetus* from oestrous mucus	Positive mucous agglutination tests	Suspicious mucous agglutination tests	Negative mucous agglutination tests
FO5	4	3	2	1	1
S12	4	4	4	0	0
FO4	2	2	2	0	0
F10	4	0	0	0	4
F9	2	0	0	1	1
S2	3	0	0	0	3
S14	3	0	0	0	3
S15	2	0	0	0	2
S17	2	0	1	0	1
G13	2	0	0	0	2
J21	2	0	1	1	0
J23	2	0	0	0	2

Vibrios were not isolated from the semen of any of these 12 bulls. Three bulls, FO5, S12 and FO4, were diagnosed as carriers of *V. fetus* based on the development of vaginal mucous agglutinins and on the recovery of the organisms from oestrous mucus. A period varying from 6 to 12 weeks elapsed before the first positive cultures were obtained. The delay was often caused by the heifers not having been observed to have returned to oestrus. One heifer inseminated with the semen of bull FO5 was culturally negative for *V. fetus* but positive to the mucous agglutination test and another heifer inseminated with the semen of the same bull was culturally positive for *V. fetus* but was negative to the mucous agglutination test. All the other heifers inseminated with the semen of these 3 bulls were positive both culturally and to the mucous agglutination test. All the strains from these heifers have been examined biochemically. They were catalase positive, reduced nitrates to nitrites, and did not produce hydrogen sulphide.

Four other heifers gave reactions to the mucous agglutination test. One heifer inseminated with semen from bull F9 gave one suspicious reaction to the mucous agglutination test but nine subsequent tests were all negative. Another heifer inseminated with the semen of bull S17 gave 3 positive and 4 suspicious mucous agglutination test reactions. The first positive reaction was given 12 days after insemination. One of the two heifers inseminated with the semen of bull J21 gave 5 out of 7 suspicious reactions to the mucous agglutination test and the second heifer gave a positive reading 3 weeks before insemination and one suspicious reading after insemination.

On subsequent examination, it was shown that these three bulls, F9, S17 and J21, were free of infection. One bull, F10, which was negative on 4 heifers on this test gave a positive result later; it is believed that this bull became infected after the first test mating.

In this experiment therefore 3 out of 12 bulls were

diagnosed as carriers of *V. fetus*. Eight of the 10 heifers inseminated with the semen of these bulls gave positive reactions to the mucous agglutination test; one gave a suspicious and one a negative reaction. Nine of the heifers were culturally positive for *V. fetus*.

Four other heifers inseminated with the semen of another 3 bulls gave either positive or suspicious reactions to the mucous agglutination test but were negative culturally. These bulls have been shown to be negative on subsequent tests on other heifers.

Experiment 2. This experiment was designed to test the efficiency of the method for diagnosing the disease in bulls as described by Adler (1952) but certain modifications were introduced. Semen was collected from two known infected bulls and preputial washings obtained, using nutrient broth. The preputial washings were centrifuged at 6,000 r.p.m. for 30 minutes and the supernatant discarded. The deposit was then taken up in 2 ml. nutrient broth and used for insemination. The semen was used undiluted and without centrifuging and the preputial washings and semen inseminated separately into different heifers, one ml. of semen or preputial washings being deposited into each horn of the uterus.

Vaginal mucus from heifers was cultured and examined for agglutinins on at least three occasions before inseminations were made, only heifers negative for *V. fetus* being used. All cultural examinations were made on Thio blood agar. Corpora lutea were expressed from suitable heifers and samples of vaginal mucus were also taken for culturing. Three days afterwards, heifers showing signs of oestrus were inseminated with either semen or preputial washings. Before the inseminations, biopsy specimens were obtained from the uterus using the apparatus described by Adler (1952) and anterior vaginal mucus collected using a bent glass tube, and cultured. Three days after insemination, and thereafter twice weekly for a period of 5 weeks, uterine biopsy and vaginal mucus samples were obtained and cultured. Corpora lutea were expressed from the heifers 7 to 10 days after insemination to prevent their becoming pregnant. After 5 weeks, samples were taken once weekly, for a period of 6 months. Vaginal mucus samples were also taken fortnightly for mucous agglutination tests. All plates were incubated at 37° C. in 10 per cent. CO_2 for 6 days and any vibrios subcultured for catalase and hydrogen sulphide production tests.

The results of this experiment are summarised in Table III.

All the heifers became infected whether they were inseminated with semen or centrifuged preputial washings. The first positive cultures were obtained from the uterine biopsy and vaginal mucus samples collected 7 days after insemination. During the first 2 months or so of infection, growth was often obtained in almost pure cultures from both uterine biopsy and vaginal mucus samples. Growth occurred either as discrete colonies, 1 to 2 mm. diameter, circular, convex, grey, opaque and homogenous, although sometimes they had a pinkish tinge or as a grey opaque shiny spreading growth. From either type of colony, growth on subculture occurred as small, grey, shiny, convex colonies. In Brewer's medium, good growth occurred aerobically as a film on the surface of the medium, gradually spreading into its depth.

During the latter 5 months of the experiment, pure cultures were often obtained from the uterine biopsy samples but growth was often contaminated from the vaginal mucus samples. All the samples from the heifers were culturally negative 7 months after the insemination. Two of the heifers were completely negative to the mucus agglutination test up to 8 months after insemination but the remaining 5 gave positive readings.

All the strains isolated in this experiment were catalase positive, did not produce hydrogen sulphide and reduced nitrates to nitrites.

The results of this experiment confirm those of Adler (1954) that a diagnosis, based on the recovery and characterisation of the organism, can be made within 4 weeks of insemination. In our experience, however, better results were obtained by culturing anterior vaginal mucus than by culturing uterine biopsy material.

TABLE III

SUMMARY OF EXPERIMENT 2.

Heifer No.	Inseminated with	Results of uterine biopsy culture			Results of vaginal mucus culture			Results of vaginal mucus agglutination tests		
		No. of samples examined after insemination	No. positive for *V. fetus*	Per cent. positive	No. of samples examined after insemination	No. positive for *V. fetus*	Per cent. positive	No. of samples examined after insemination	No. positive	Per cent. positive
45	Semen of Bull DH	34	14	41	35	22	63	14	7	50
51	" " "	34	16	47	37	22	60	14	2	14
66	" " "	34	18	53	37	15	40	14	2	14
52	Centrifuged preputial washings of Bull DH	34	17	50	37	23	62	14	10	71
49	Semen of Bull ED	34	21	66	36	25	70	14	3	21
57	" " "	33	4	12	37	19	51	14	0	0
68	Centrifuged preputial washings of Bull ED	33	9	27	37	15	40	14	0	0
	Totals	236	99	42	256	141	55	98	24	24.6

During the 7-month period of examination, 42 per cent. of the uterine biopsy and 55 per cent. of the vaginal mucus samples were culturally positive for *V. fetus*. Of a total of 42 uterine biopsy and 42 vaginal mucus samples taken during the first 4 weeks of infection from the 7 heifers, 48 per cent. of the biopsy and 70 per cent. of the vaginal mucus samples were culturally positive for *V. fetus*.

Experiment 3. In this experiment, a survey was made of the incidence of the disease in bulls in two artificial insemination centres. The methods used were essentially the same as those described in experiment 2 above except that cultural examinations of uterine biopsy and vaginal mucus samples were made twice weekly for 3 weeks, starting at a week after insemination. After this period, any heifers that were culturally negative were subsequently re-inseminated with the semen of another bull. One heifer was inseminated per bull. No heifer was inseminated more than once with the semen of the same bull.

Any vibrios found were subcultured and pure cultures examined biochemically. Thirteen bulls were diagnosed as carriers of *V. fetus* based on the recovery of the causal organism from the inseminated heifers. The results were as follows:

TABLE IV

Bull	Heifer No.	Cultural results a		Biochemical properties of the isolated vibrios		
		Uterine biopsy	Vaginal mucus	Catalase	H_2S production	Reduction of nitrates
G17	76	5/6	6/6	+	–	+
F2	65	5/6	6/6	+	–	+
F10	78	4/4	6/6	+	–	+
S1	48	2/6	6/6	+	–	+
F2	60	5/6	6/6	+	–	+
A1	70	4/6	6/6	+	–	+
H1	87	2/6	6/6	+	–	+
A2	56	2/6	5/6	+	–	+
S2	75	2/6	4/6	+	–	+
F4	59	1/6	5/6	+	–	+
F5	55	0/6	3/6	+	(–) b	+
S3	94	3/6	5/6	+	(–) b	+
H2	98	3/6	6/6	+	–	+
Total		38/76=50%	70/78=90%			

a Numerator = No. of samples positive for *V. fetus*.
Denominator = No. of samples examined.
b = Slight browning of lead acetate paper.

From the table it can be seen that 50 per cent. of the uterine and 90 per cent. of vaginal mucus samples were culturally positive for *V. fetus*. In all cases, the isolated vibrios were catalase positive, reduced nitrates to nitrites and did not produce hydrogen sulphide except for two strains which produced slight browning of the tip of the lead acetate paper.

Thirty-two other bulls were similarly examined and, from the majority of the heifers inseminated with the semen of these bulls, no vibrios were recovered. From 4 heifers inseminated with the semen of 4 different bulls, *V. fetus* was recovered on one occasion only from each heifer. Whether these were avirulent strains of *V. fetus* that were rapidly killed off in the vagina or the result of accidental contamination of the particular samples is not known. These 4 bulls have been examined repeatedly on further heifers and, in all cases, these have been completely negative.

Since it is not known whether an infected bull is infectious at all times or whether heifers resistant to infection with *V. fetus* occur, all the bulls which were negative on the first examination have been examined twice at 6-monthly intervals. In no case was *V. fetus* isolated.

From a proportion of the inseminated heifers, catalase negative vibrios were isolated, but they were not recovered regularly from any particular animal. This was in marked contrast to the regular recovery of *V. fetus* from infected animals. Catalase negative vibrios were isolated from 3 unmated animals. Further it was found that the catalase negative vibrios isolated from a heifer were serologically distinct from the ones isolated from the semen and prepuce of the bull used for the insemination of that particular heifer. But, of the catalase negative strains so far examined, it was not possible to distinguish serologically between strains isolated from bulls and those isolated from heifers.

Morphological, cultural and biochemical properties of V. fetus *isolated from vaginal mucus of infected heifers.* On the primary isolation plates, two types of growth were found. One type consisted of a grey, shiny film with a bluish tinge to the periphery and the second type consisted of discrete colonies up to 2 mm. in diameter, circular, convex, grey, homogenous with an entire edge. Often, the two types of growth were seen on the same plate (fig. 1b). In both cases, growth was easily emulsifiable. Both types, on subculture, gave small, discrete, grey, shiny, convex colonies; growth was often scant on the first subculture but improved on further passage. The cells were actively motile, and, in smears, consisted of short spirals about 2 μ long (fig. 2b). On subculture, longer spirals consisting of two or more cells end to end were found. On blood agar plates, no growth occurred aerobically but, in Brewer's medium, good growth occurred aerobically at a temperature range of 25° to 39° C. as a thick band on the surface of the medium slowly spreading into its depth. All the strains were catalase positive, did not produce hydrogen sulphide and reduced nitrates to nitrites.

Work on the serology of *V. fetus* is in progress and will be reported upon later.

Discussion

Only 3 of the bulls reported by Stewart *et al.* (1951) to have a significantly increased conception rate following the addition of streptomycin to semen diluent were available for this study. Later experiments confirmed that these 3 bulls still showed an increased conception rate by the addition of streptomycin to the semen diluents. Two of these bulls, FO4 and S12, were shown to be infected with *V. fetus* but the third bull, S14, was negative on repeated test-matings.

It follows therefore that not all bulls which have an increased conception rate following the addition of streptomycin to semen diluent are necessarily infected with *V. fetus*. *Pseudomonas pyocyaneus* was regularly recovered from the semen of the third bull S14 but this organism has also been recovered from the semen of bulls with high conception rates.

Cultural examination of semen and preputial samples proved unsuccessful for the diagnosis of *V. fetus* infection in bulls but the result showed that catalase negative vibrios were commonly recovered from these sources. It is, therefore, important to differentiate these catalase negative strains from *V. fetus* in diagnosis. The insemination of vibrio-free heifers with the semen of bulls and the isolation of *V. fetus* from the genital organs of such heifers proved to be the most satisfactory method for diagnosis based on the regular recovery of the organisms from the genital tract and on their biochemical properties to confirm that they were, in fact, *V. fetus*. The results obtained were generally in agreement with those reported by Adler and his colleagues and indicate that the use of a single test heifer per bull is justified where anterior vaginal mucus is cultured during the early stages of the disease. During this stage, the culture of oestrous mucus was not superior to culturing di-oestrous mucus.

When samples were cultured within the first four weeks after insemination, anterior vaginal mucus yielded approximately twice the number of positive cultures compared with uterine biopsy specimens. No differences were found in the biochemical properties of the strains of vibrios isolated from these two sources. In view of the satisfactory results obtained by culturing anterior vaginal mucus, uterine biopsy sampling has now been discontinued since it was more damaging to the test heifers.

All bulls that were negative at the first examination were also negative at all subsequent examinations. A heifer that had been inseminated with the semen of as many as four different negative bulls could still be readily infected with *V. fetus* semen thus showing that continual test mating did not render heifers resistant to infection.

Catalase negative and H_2S positive vibrios were recovered from the vaginal mucus of a proportion of heifers after insemination with the semen of "clean" bulls. These were not recovered regularly from any particular animal—often only a few times. Catalase negative vibrios were isolated from the vaginal mucus of three heifers that had not been inseminated or served previously. Similar findings were reported by Frank, Bryner and Caruthers (1956).

Acknowledgments.—We wish to acknowledge our gratitude to the Bacteriology Department of the National Institute for Research in Dairying for providing facilities and to Messrs. J. R. Lawson and D. J. MacKinnon for doing the mucous agglutination tests, and for supplying semen from infected bulls. The assistance of the staff of the Reading Cattle Breeding Centre is also acknowledged.

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THE WELLCOME HISTORICAL MEDICAL LIBRARY

Veterinary surgeons who come to London from time to time, and who, perhaps, have an hour or two to spare, would find great profit and interest in paying a visit to this noted library. Research workers, and those interested in the history of medicine will, no doubt, be familiar with it already.

The library contains original works, first editions, and manuscripts of almost priceless value, through which the history of medicine, veterinary surgery, and kindred sciences may be followed from classical times. Many of the texts, apart from their intrinsic interest, are in the form of illuminated books of great beauty, even to look at which is an enjoyment. Space does not permit of detail on this occasion, but a number of the rarer veterinary works were described in an article in this journal in 1950 (VET. REC. **62.** 481).

Books cannot be borrowed, but the library is open for purposes of viewing the works, or of study, from Mondays to Fridays between the hours of 10 a.m. and 5 p.m., and here is a historical and scientific feast that really is too good to be missed.

AREA ERADICATION PLAN FOR TB

Since March 1st, 1957, the Ministry of Agriculture and the Department of Agriculture for Scotland have provided free tuberculin tests for cattle in the following areas which are due to be declared Tuberculosis Eradication Areas on March 1st, 1959:—

ENGLAND AND WALES. (a) Cornwall and West Devon.

(b) Flintshire, Shropshire, Herefordshire, Monmouthshire, Worcestershire (excluding Dudley), Gloucestershire, Bedfordshire, Hertfordshire, Middlesex, London, Essex, Cambridgeshire (excluding the Isle of Ely), West Suffolk, East Suffolk, Norfolk, the remainder of Denbighshire, Glamorgan, Oxfordshire and Buckinghamshire; a part of Northamptonshire (1) and of Warwickshire (2).

(c) Part of the West Riding of Yorkshire (3).

(d) Part of Durham (4) and the North Riding of Yorkshire (5).

SCOTLAND. Aberdeen, Angus, Kincardine and North Banff.

Arsenico-phenol Poisoning in a Dairy Shorthorn Herd

BY
A. T. MORGAN
Carmarthen
AND
E. I. WILLIAMS
St. Clears, Carmarthenshire

Introduction

Even though our practice covers "Under Milk Wood" country, we assure our readers that the case history recorded here is not an extract from that fantasy:

History

A telephone call at 6.30 a.m. on June 18th, 1957, was received from a bewildered client who sought immediate attention to his dairy herd, several of which were found in a state of collapse on being collected for the morning milking. He volunteered the information that he had dressed them on the previous evening with fly dressing, painted along their backs.

Examination

On arrival, one of us (E. I. W.) was presented with a herd of 28 milch cows which could be grouped, symptomatically, as follows:—

(a) 15 cows in apparently normal health except for slight salivation and a characteristic, pinkish coloration of the membrana nictitans.

(b) 6 cows showing inco-ordination of movement, profuse, watery diarrhoea, and grinding of the teeth. There was no evidence of tenesmus or melaena.

(c) 4 animals had collapsed on the farm-yard, with paddling of the limbs, accelerated, shallow breathing, subnormal temperature, grinding of the teeth, and with evidence of a profuse diarrhoea.

(d) 3 cows were later found dead in an adjoining field.

Procedure

All the affected animals were treated immediately with stimulants and those in a state of collape were given calcium borogluconate intravenously. The owner and his staff were instructed to remove the remaining dressing from all the animals and warned not to drink or sell any milk. The dead animals were removed to a knacker's yard for *post-mortem* examination (by A. T. M.) and a sample of the fly dressing from the drum was taken to the public analyst at Carmarthen for immediate analysis.

Post-mortem examinations of the 3 animals revealed an almost identical picture, *viz.*, intense gastro-enteritis with a typical rose-red coloration of the body musculature. The subcutaneous tissue adjacent to the hide where the dressing had been applied was inflamed, giving a reddish, gelatinous appearance.

Diagnosis

An immediate preliminary qualitative analysis of the sample revealed a strong reaction for arsenic and phenol. A diagnosis of arsenico-phenol poisoning due to the absorption and/or ingestion of the dressing was submitted.

Subsequent History

On a return visit in the early afternoon, it was learnt that 2 more cows had died and that some of the others which had only shown mild symptoms in the morning had collapsed. Two died in the evening, two during the night, and one on the following afternoon.

Five of the animals which showed symptoms of staggering movements on the first visit continued to show signs of profuse diarrhoea, subnormal temperature, accelerated respiration, weak pulse, grinding the teeth, slight salivation, and intermittent colic for several days. They were treated symptomatically, and moist ferric hydroxide was given liberally though its value was questionable (no B.A.L. being available).

The faeces became normal after 4 days: the appetite improved gradually but swaying of the hind quarter persisted for 7 to 9 days. The owner reported that milk from the unaffected cows showed a peculiar "colostrum-like" appearance for several days and that several of these animals salivated slightly for a few days. (Glover (1952) reported that milk from cows affected by arsenical poisoning, gave an alkaline reaction when tested with bromo-thymol blue.) The unusually bright coloration of the visible mucous membranes in the apparently normal and the sick animals disappeared after 3 to 4 days. Most of the animals developed a dermatitis along the back which responded satisfactorily to treatment with calamine lotion.

Discussion

In view of the danger to human health, the local Medical Officer of Health was consulted. All milk sales from the farm were prohibited and samples were submitted for analysis of arsenical content at intervals until the Medical Officer was satisfied that the milk was safe. Samples were also taken from the 5 cows showing symptoms of ill-health and which subsequently recovered; from rinsings of the milking-machine clusters and containers; and from the meat and bone meal made from the carcases (see overleaf).

The Royal Commission on arsenical poisoning (1903) recommended that the limit of arsenic for liquid food should be 1/100 gr. As per gallon. More recently a report of the Food Standards Committee, 1955, set up by the Ministries of Health and Agriculture, recommended that Statutory effect be given to the limits proposed by the original Commission, subject to periodic review, and that for beverages ready

ANALYST'S REPORT

A quantitative analysis of the liquid revealed the following contents :—

	Parts by weight.
Arsenic as As_2O_3	7.32
Calculated as Sodium Arsenite	14.20
Phenols, as C_6H_5OH	10.73
Sodium Carbonate	5.80
Water—to produce	100 parts by volume.

MILK SAMPLES, ETC.

Date	Description of sample	Arsenic content (Parts per 1,000,000
18–6–57	Milk from cows treated with liquid but showing no symptoms ...	2.0
	Milk from cows showing symptoms	0.9
22–6–57	Milk from cows not showing symptoms	0.6
	Milk from sick animals	0.5
24–6–57	Bulk sample from healthy cows ...	nil
	Milk from sick cows	0.1
28–6–57	Milk from healthy cows	nil
	Milk from sick cows	0.03
5–7–57	Milk from bulk supply of healthy cows	nil

Owner was allowed to sell milk after the last test result

Rinsings from milk churns, milking machine clusters, buckets, etc., were all negative.

A sample of meat and bone meal from the carcases was also negative.

to drink (milk being included), a limit of 0.1 parts of arsenic as As should be imposed.

It is significant that the milk sample taken on the first day from cows treated with dressing, but showing no symptoms, contained 2 parts per million of arsenic, whilst a sample from the affected cows only contained 0.9 parts per million (recommended legal maximum being 0.5 parts per million for liquid beverages ready to drink). This first sample from the non-affected cows was actually taken from the household milk jug and it was later ascertained that the farmer's wife had used some of it for a milk pudding. The writers were relieved to find later that a telephone call to the farm from Carmarthen immediately a qualitative preliminary test had shown the presence of arsenic, prevented the milk pudding getting on the lunch menu!

Discussion with the owner revealed that he had recently constructed a modern milking parlour and that the system adopted is one where the cows are penned in the farm-yard until the milking rota is completed. On this particular evening (June 17th, 1957), the cows were unusually restless due to fly activity. The owner recalled having purchased a tin of fly dressing at a farm sale several years previously. As a precaution, he applied some to the back of his hand and finding that it was non-irritant, proceeded to dress the milch cows, painting the liquid liberally along their backs from the withers to the root of the tail, covering an area of about 6 inches, each side of the spine. Approximately one pint of the dressing was applied per 5 animals (4 fl. oz. per animal). It is presumed that intoxication occurred by direct absorption through the skin which was probably aided by the very hot weather conditions prevailing that evening and the presence of warbles on some of the cows. It is also possible that some of the dressing was ingested by licking the back. However, the *post-mortem* findings of acute gastro-enteritis do not prove the latter factor because arsenic is excreted into the alimentary canal after absorption through the skin (Hoare, 1948).

Garner's "Veterinary Toxicology" states that the toxicity of arsenical compounds depends on their chemical composition and on their solubility—powdered arsenic being relatively non-toxic whilst arsenites are far more lethal. For cattle the following lethal doses (by mouth) are given:—

As_2O_3 — 14.00 to 45.00 g.

Sodium arsenite — 1.00 to 4.00 g.

From the analysis, it was deduced that the so-called fly dressing was probably a sheep dip to be used after very great dilution, or possibly weed killer.

Conclusions

This case history reveals the following important factors:—

(a) The varying tolerance of adult cattle to arsenic when absorbed or ingested.

(b) The secretion of arsenic in the milk by the apparently healthy cows which might have had disastrous consequences.

(c) The acceptance of the owner's history regarding fly spray, although given (and administered by him) in good faith, could have been misleading.

(d) This case again emphasises the need to warn farmers against purchasing proprietary medicines, dressings, etc., at farm sales, without ascertaining their true identity. [This point might seem outrageous, but all the same far too prevalent.]

(e) In view of the danger to public health, the responsibility for prohibiting the sale or consumption of the milk at this farm was referred to the local Medical Officer of Health under whose jurisdiction such powers are vested.

Acknowledgments.—We record our grateful thanks to the following: Herbert J. Evans and Partners, Analytic and Consulting Chemists, Carmarthen, for carrying out the chemical analysis and for their prompt co-operation in this urgent problem; Dr. Elfyn T. Jones, M.O.H., Carmarthen Rural District Council, for his co-operation and kind permission to publish the report on the milk samples, etc., and Mr. W. Williams, Senior Public Health Inspector, Carmarthen R.D.C., for his co-operation.

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The Effects of Different Castration Methods on the Growth and Well-being of Calves

BY

B. K. FENTON

Royal Veterinary College Field Station, Streatley

J. ELLIOT

Agricultural Research Council Field Station, Compton

AND

R. C. CAMPBELL

Agricultural Research Council Statistics Group, University of Cambridge

SUMMARY.—Seventy-six calves were allocated to three groups for castration by three different methods: "Burdizzo," "Elastrator," and "Open." Eight calves were left uncastrated as controls.

The physical changes and weight gains of the calves in each group were recorded weekly for 6 weeks. Statistical analysis showed significant differences in growth rate between castrated and uncastrated animals.

A very significant difference in growth rate between the animals in the "Elastrator" group and the remaining groups is recorded in the week ending on the 28th day after castration. The difference coincided with the more prolonged period of pain and sepsis which is characteristic of this rubber-ring method.

WHEN castrating an animal it is desirable to carry out the operation with the minimum of disturbance to health and growth, *i.e.* with the minimum of pain, haemorrhage, and sepsis.

After examining all the available literature, we have been unable to find any mention of a controlled experiment specifically designed to compare the common methods of castration of calves, which is the object of this investigation.

Animals and Methods

The calves used had been assembled at Compton for an experiment on the value of immunisation in the control of husk and to fulfil the conditions of the experiment it was necessary that these animals should be slaughtered at 3 months of age. The allocations to the various castration groups and to the immunised and non-immunised groups were arranged so that the results of the two experiments could be interpreted separately. The calves were brought from Scotland by road when approximately one week old and were castrated when about 7 weeks old.

As the primary object of the experiment was to compare the effects of the "Burdizzo," "Elastrator," and "Open" methods of castration, the 84 calves available were randomised into 3 groups of 28. It was later decided, however, to keep 8 uncastrated calves from the "open" group to serve as controls.

The calves were housed in identical cement-lined loose-boxes, bedded with straw, in the Isolation Compound at Compton, and were reared under standard conditions of management. They were weighed and examined clinically before castration and every week for 6 weeks thereafter. Details of the castration procedures are described below.

"Burdizzo" Method

The Burdizzo emasculator was used. This instrument is designed for bloodless castration by means of the crushing action of two jaws which are applied to each cord in turn. When the jaws are closed upon the spermatic vessels these are occluded and the main blood supply to the testicles disrupted. To ensure that occlusion of the vessels was complete the instrument was applied 3 times to each cord.

"Elastrator" Method

The elastrator is an instrument designed to stretch a strong rubber ring and enable the operator to place it over the neck of the scrotum. The tourniquet-like action of the contracted ring upon the spermatic vessels cuts off the blood supply to both scrotum and testicles.

"Open" Method

The testicles were exposed by separate incisions and removed with an emasculator which, by crushing the spermatic vessels, minimised bleeding. Strict surgical principles were observed.

Physical Changes

Details of the clinical observations are given in Table I (overleaf).

Effect on Growth

The mean live-weight of the calves at castration was 105.5 lb. In the 5 weeks following castration the 8 control calves gained an average of 65.9 lb., whilst the 76 castrated animals gained an average only of 49.1 lb.; details of weight gains are given in Table II. The differences in overall weight gain between the 3 methods of castration were not significant, but the difference between the control and the average of the castration treatments was significant. The difference in the weekly results showed much the same pattern as in the overall result, except during the 4th week when there was a low weight gain in the elastrator group which accorded well with the clinical observations.

TABLE I.
WEEKLY EXAMINATIONS OF PHYSICAL CHANGES

Time of examination	"Burdizzo"	"Elastrator"	"Open"
Immediate	No discomfort following crushing of the spermatic cord.	Discomfort caused by application of rubber ring disappeared within an hour. Three calves refused the afternoon feed.	Behaviour normal.
7th day	Tumefaction of testicles and scrotum. Scrotal sac distended and turgid with oedematous fluid. Signs of discomfort. Pain on palpation.	Only 3 calves showed evidence of pain and in each there was swelling above the ring.	Fourteen calves showed slight swelling of the severed cord. No evidence of pain on palpation.
14th day	Testicles and scrotum less tumefied. Little pain on palpation.	Shrinkage and dry necrosis of testicles and scrotum in ali calves. Signs of pain only in the 3 calves mentioned above.	Four cases exhibited swelling at site of operation. No pain. One case swollen, infected and painful.
21st day	Testicles reduced in size and firmer than normal. Scrotum smaller and no longer oedematous. No pain on palpation.	Impossible to palpate testicles. In 18 calves there was painful reaction above the ring and in 6 of these the ring had penetrated to cause ulceration of the skin. Ten animals showed no change from previous week.	Swelling in one calf only. Infected calf recovered. All wounds healthy and healing. No pain.
28th day	Further reduction in size of both testicles and scrotum. No pain.	Ulceration and painful reaction of the rubber ring in all 28 calves. One calf found to have testicles above the ring in the inguinal region–presumably due to sucking of the scrotum by other calves.	Except for the case which was swollen on the 21st day, all calves in this group were completely healed. No pain.
35th day	Average diameter of testicles 1 cm. compared with 2.2 cm. of controls. Measurement includes scrotal skin. In 4 cases the testicles were located in the inguinal canal. No pain.	Scrotum in one case had sloughed. Pus at site of ulceration in remainder. Swelling above the ligature in all cases was reduced as was the degree of pain.	The calf exhibiting swelling on the 28th day continued to do so on the left side. No pain.
42nd day	In 9 calves the testicles could be palpated and were the size of peas and hard. In the remaining 19 the testicles were difficult to palpate because of retraction into the inguinal canal. No pain.	Some evidence of swelling and pain in all calves.	Calf swollen on left side—no change. No pain.

Discussion and Conclusion

Although only a limited number of calves were used in this experiment it would appear from the results that, initially at any rate, castration irrespective of method retards growth rate and weight increase. When a comparison of the 3 different methods of castration is made several factors have to be considered, including efficiency of emasculation, effect on growth rate, sepsis, and by no means of least importance, pain.

The "Burdizzo" method has often been criticised for failing to emasculate effectively, but this in the majority of cases is due to inefficiency of technique rather than to any fault in the instrument itself. An obvious advantage of this method is the absence of sepsis which must necessarily reduce pain over a period. Crushing of the cord inevitably produces tissue reaction and oedema which are responsible for more pain during the 2 weeks immediately following castration than is seen in the calf castrated by incision.

TABLE II
WEEKLY MEAN WEIGHT GAINS OF THE CONTROL AND CASTRATED GROUPS

Week after castration	Control	"Burdizzo"	"Elastrator"	"Open"	Sig: 1	Sig: 2
1	11.71	8.12	9.12	9.50	n.s.	*
2	11.00	7.68	8.12	7.45	n.s.	n.s.
3	15.00	11.20	10.50	10.85	n.s.	*
4	13.29	11.52	8.73	10.40	*	*
5	14.86	12.40	10.73	10.95	n.s.	*
Total	65.86	50.92	47.20	49.15	n.s.	***

Sig : 1. Expresses the significance of the difference between castration methods.

Sig : 2. Expresses the significance of the difference between the control and the average of the castration treatments.

The significance levels were obtained from one-way classification analysis of variance of the individual weight gains. (n.s. means not significant ; *, *** mean significant at the 5 per cent., 0.1 per cent. level).

Advances in the Pharmacology of Thiopentone Sodium

BY

D. E. STEVENSON

Department of Veterinary Clinical Studies, University of Cambridge

SUMMARY.—1. *The rate of recovery from thiopentone narcosis depends primarily on the speed of distribution of thiopentone from the blood to the soft tissues and then to the body fat.*

2. *The rate of detoxication of thiopentone is much slower than was originally thought.*

3. *Repeated injections of thiopentone cause progressively longer periods of narcosis.*

4. *Thiopentone appears to cross the blood-brain barrier at a very fast rate.*

5. *Thiopentone has a depressant action on respiration and on the heart.*

6. *Where shock, anaemia, liver damage, or uraemia are present thiopentone must be given with great care.*

7. *Premedication or the simultaneous use of analgesic agents reduces the dose of thiopentone necessary to produce a given depth of narcosis.*

8. *Pentobarbitone does not become localised in the body fat and in the dog may be detoxicated at a faster rate than thiopentone. Pentobarbitone does not enter the brain with the same speed as thiopentone.*

The Effects of Different Castration Methods, etc.—*Concluded.*

There can be no argument about the effectiveness of the "open" method and it becomes apparent here that pain is linked with sepsis rather than pressure as in the "Burdizzo" group. Provided strict surgical principles are applied this old-established method must have much to commend it.

The placing of a constricting rubber band above the testicles has grown more popular during recent years and no doubt much of the popularity is due to the ease and speed with which lambs and calves are dealt with by the layman. Failure to emasculate can occur due to loss or displacement of the rubber ring by companion calves sucking the scrotum. Most frequently, however, it is due to the inefficiency of the operator in not seeing that the ring is above the testicles. It is not always easy (especially in lambs) to overcome the voluntary retraction of the testicles at the time the rubber ring is being placed in position. The degree of pain, mainly due to sepsis, is greater and more prolonged. This is reflected in this group showing the lowest weight gain.

From the evidence obtained in this experiment, it is our opinion that the "Burdizzo" method is the one having the minimum retarding effect upon the calf's progress.

Acknowledgments.—We should like to thank Professor C. Formston, F.R.C.V.S., and Dr. W. S. Gordon, C.B.E., PH.D., F.R.S.E., M.R.C.V.S., for their help and encouragement in preparing this article.

ALTHOUGH thiopentone sodium has become one of the most widely used anaesthetic agents in veterinary practice, veterinary literature contains very few references to the pharmacology of the drug. At the time of its introduction into this country (Wright, 1937; Sheppard & Sheppard, 1937), the short duration of narcosis obtained from a single injection of this compound was thought to be due to the rapidity with which detoxication occurred. However, cumulative effects were often noticed if anaesthesia was prolonged by further injections, and the suggestion was made that the detoxication mechanisms could only metabolise a limited amount of thiopentone (Reynolds, 1939; Wyngaarden, Woods, Ridley & Seevers, 1949). Another suggestion was that a degradation product of thiopentone which has narcotic properties might be produced in the body (Maynert & van Dyke, 1949).

Recent work has shown that the original concept of a fast rate of detoxication is wrong. Since this fact has only briefly been reported in the veterinary literature of this country (Fitzpatrick, 1957), an account of the present views might be of interest to those practitioners who use thiopentone as a narcotic agent.

The Fate and Distribution of Thiopentone After Injection

Brodie and his colleagues followed the concentrations of thiopentone in various body tissues and in urine for several hours after intravenous injection, both in the dog and in man (Brodie, Mark, Papper, Lief, Bernstein, Rovenstine, 1950; Brodie, Bernstein & Mark, 1952; Brodie, Burns, Mark, Lief, Bernstein & Papper, 1953). It was found that the liver and plasma concentrations of thiopentone, which were maximal almost immediately after a single intravenous injection, soon fell rapidly. The muscle concentration, although high almost immediately after injection, continued to rise for some 20 minutes, after which it began to fall. The plasma and muscle concentrations then fell in a similar manner. The fall was fairly rapid for the first hour, but became progressively slower during the next 2 to 3 hours.

In contrast to these changes, the concentration in the body fat, although negligible at first, increased rapidly during the first hour and then more gradually, reaching a maximum in from 3 to 6 hours in the dog. The concentration in the fat rose at the expense of that of the plasma and all other tissues studied.

The rate of detoxication of thiopentone varies with the species. Brodie *et al.* (1950) found that in man the plasma concentration dropped at a rate of 10 to 15 per cent. per hour once equilibrium had been reached between the concentrations in the plasma and the fat. Since very little thiopentone is excreted unchanged in the urine (Brodie *et al.*, 1952), the fall in the plasma concentration at this stage must be due

to detoxication. In the dog the rate of detoxication was estimated at about 5 per cent. per hour. The rates in other domestic animals do not appear to have been estimated. Shideman, Gould, Winters, Peterson and Wilner (1953) found that the rate of detoxication in the rat was of a similar order to that found in man.

Although the brain concentration is above that of the plasma, both show parallel changes and therefore the depth of narcosis is related to the plasma concentration of thiopentone. The factors which govern the length and depth of narcosis are: 1, the speed of injection; 2, the amount of thiopentone injected; 3, the rate of distribution of thiopentone in the non-fatty tissues of the body; 4, the rate of uptake of thiopentone by the body fat. The speed of injection and the amount injected are interdependent, for a small amount injected at a fast rate will produce a high plasma concentration and a parallel high brain concentration. As a result narcosis occurs quickly. However, the plasma concentration will soon drop due to distribution in the non-fatty tissues of the body. In contrast, a slow rate of injection has the effect of replacing the thiopentone which has become distributed in the body. This means that a larger amount of thiopentone will be necessary to obtain a given depth of narcosis and recovery will depend more on the uptake of thiopentone by the body fat, since the concentration of thiopentone in the non-fatty tissues will already be relatively high at the end of injection. The rate of uptake of thiopentone by body fat is governed by the degree of vascularity of the fat depots, the fat-water solubility coefficient of thiopentone and the relative concentrations of thiopentone in the watery and fatty parts of the body.

Thiopentone appears to cross the blood-brain barrier with very great speed. The factor which limits the time of response following a rapid injection is probably the circulation time from the injection site to the brain rather than the time taken to enter the brain tissues. Mark, Burns, Campomanes, Ngai, Trousof, Papper and Brodie (1955), found that the ratio of the plasma concentration to that of the brain 30 seconds after a rapid injection, was unchanged 3 hours later. These workers believe that in fact there is no blood-brain barrier for thiopentone.

The Effect of Thiopentone on Respiration

A variable period of apnea may follow the injection of thiopentone. This is probably due to the central depression caused by high plasma concentration (Dripps & Dumke, 1943; Dripps & Severinghaus, 1955). The sensitivity of the respiratory centre to carbon dioxide is reduced, this becoming increasingly marked as narcosis deepens. As a result of the diminished alveolar ventilation the carbon dioxide content of arterial blood is raised. The rationale of using carbon dioxide in the treatment of thiopentone induced apnea is doubtful, owing to the degree of central depression already present. Indeed, in deep narcosis the administration of carbon dioxide may cause further depression instead of stimulating respiration (Dripps & Dumke, 1943; Goodman & Gilman, 1955).

As narcosis deepens, respiration becomes more dependent on the integrity of the vagus nerve. This may be due to the stimulation from the aortic body chemoreceptors, but pulmonary stretch receptors may also be involved. It has been noticed that during apnea a slight squeeze on the rebreathing bag, or pressure on the chest wall initiates a voluntary inspiration. Scott, Reed, Saris and Ramirez (1948) found that this response was abolished by bilateral vagotomy.

Carbon dioxide retention or the administration of carbon dioxide has the effect of reducing the plasma *p*H. This has a complex effect on the distribution of thiopentone in the body. Thiopentone is partially ionised and acts as a weak organic acid, the dissociation constant of which is such (pKa 7.6) that a small change in *p*H will markedly affect the degree of ionisation. If the plasma *p*H is lowered by the administration of carbon dioxide, the undissociated fraction of thiopentone is increased. Only this fraction is fat soluble and as a result a decrease in *p*H increases the uptake of thiopentone by the body fat. This causes a reduction in the plasma concentration of thiopentone (Brodie, 1952; Brodie & Hogben, 1957).

The reduction of the plasma concentration of thiopentone by the administration of carbon dioxide does not result in a lightening of narcosis as might be expected (Rayburn, Whitehead & Draper, 1953). Brodie and Hogben (1957) suggest that although the total plasma thiopentone is reduced, the concentration of undissociated thiopentone remains roughly the same. They therefore suggest that this fraction is responsible for pharmacological activity.

A further factor may be important as thiopentone is bound to the plasma protein to a considerable degree, depending on the *p*H of the plasma and the protein concentration. Goldbaum and Smith (1954) working with solutions of bovine albumin found that the degree of binding is reduced by a reduction in *p*H over the physiological range. Since pharmacological activity resides in the ultra-filterable fraction of this solution, a reduction in plasma *p*H may increase the unbound fraction of thiopentone apart from any effect which may be produced on the dissociation of thiopentone.

Hyperventilation, which might be expected to have effects opposed to those caused by hypercapnia, may also reduce the amount of thiopentone necessary for maintenance of anaesthesia (Dundee, 1952). These results are not necessarily contradictory since there are three factors, the uptake of thiopentone by the body fat, the degree of dissociation and the degree of binding by the plasma proteins, which effect the active concentration of thiopentone. These factors are not all effected to the same degree and in the same way by *p*H changes.

The Effect of Thiopentone on the Cardiovascular System

There is considerable disagreement among research workers concerning the effects of thiopentone on blood pressure, cardiac output and peripheral resistance. This may be partly due to the varying methods used for determinations including differences of premedication, the depth of narcosis and the degree of carbon dioxide retention.

The effect of thiopentone on blood pressure is probably subject to a species variation. In the dog, Gruber (1937) found that the rapid injection of thiopentone caused a sudden fall in blood pressure. However, within 5 minutes the blood pressure had returned to, or above, the control level. If the injection of thiopentone was made over a period of several minutes, there was either no change, or a slight rise in blood pressure. These changes were confirmed and further investigated by Gruber, Gruber and Lee (1952). On the other hand Woods, Wyngaarden, Rennick and Seevers (1949) appeared to find no significant change in blood pressure in dogs unless respiration had become severely depressed, when the blood pressure fell. In man, it is generally considered that thiopentone causes a decrease in blood pressure (Dundee, 1956).

Thiopentone appears to have a direct depressant action on the myocardium and in certain circumstances may produce cardiac arrhythmias such as ventricular extrasystoles (Gruber, 1937). In the dog these often take the form of one normal beat and one premature beat in an accurate coupling. This rhythm may arise quite suddenly and may pass off without any intermediate phase. Gruber, Gruber and Lee (1952) suggest that thiopentone causes constriction of the coronary arteries and that the resultant tissue anoxia is the cause of arrhythmias. This has been disputed by Dundee (1956), however, who considers an electrolyte imbalance due to carbon dioxide retention to be a likely cause. Nevertheless it must be noted that Spencer, Parry, Whitehead and Draper (1950) found it difficult to produce arrhythmias in the dog by the inhalation of carbon dioxide, even in large amounts. It is doubtful whether the arrhythmias found have any clinical significance, since they do not appear to progress to fibrillation and they pass off spontaneously. The electro-cardiograph provides the best proof of their presence.

Pathological Conditions Affecting the Dosage of Thiopentone

Shock may considerably reduce the amount of thiopentone necessary for narcosis. It is interesting to note that Halford (1943), when discussing the surgical treatment of casualties at Pearl Harbour, wrote that intravenous anaesthesia under such conditions was "an ideal form of euthanasia." This was due to the fact that it was not realised at that time that the dose for a healthy subject must be considerably reduced for a shocked patient. The circulation time from the injection site to the brain may be greatly increased in the presence of shock, so that a longer period of time will be necessary to assess the effects of a given dose.

Anaemia is known to reduce the amount of thiopentone necessary for a given depth of narcosis. The explanation of this is not fully known, although it has been suggested that cerebral cells may be more sensitive to thiopentone under conditions of anaemic anoxia (Dundee, 1956). In many types of anaemia the plasma proteins are considerably reduced and the decreased binding of thiopentone in the plasma could well account for the increased sensitivity to this agent.

Where myocardial damage is present, it is unwise to use a very rapid rate of intravenous injection for thiopentone since this will submit the heart to a very high initial concentration.

Liver damage does not make the use of thiopentone unsafe so long as only minimal doses are used (so that recovery of consciousness depends on redistribution in the body tissues). If large or repeated doses are used, then recovery may be very slow.

It is well known that uraemia increases the length of thiopentone narcosis. In this condition there may be a reduction in the proportion of thiopentone bound to the plasma proteins (Taylor, Richards, Davin & Asher, 1954). Although these workers found that binding by normal plasma *in vitro* was not influenced by the addition of large amounts of urea, Dundee (1956) suggested that the increase in duration of narcosis in nephrectomised animals does not occur until the blood urea rises. Since Wacker (1957) has suggested that the central effects of uraemia may be due to an accompanying elevated concentration in plasma magnesium and this element is known to potentiate the effects of anaesthetic agents, this rise may play some part in the increased sensitivity to thiopentone.

The Effect of Premedication on the Dosage of Thiopentone

The use of premedicant drugs decreases the amount of thiopentone necessary to obtain a given depth of narcosis. Among the drugs used, chlorpromazine is now perhaps one of the most popular. This drug makes the animal less apprehensive and a smooth induction of narcosis is usual. Chlorpromazine appears to have a variable effect on the length of thiopentone narcosis (Schweizer, 1954).

Since thiopentone does not possess good analgesic properties a relatively large dose is necessary before all reflex response to pain is lost. Specific analgesic agents such as morphine, papaveretum ("Omnopon") and pethidine greatly reduce the amount of thiopentone required to reach this point.

Breed Differences in the Dog

No work has been done on the breed differences in response to thiopentone. It is interesting to note, however, that Hermann and Wood (1952) found that in the rat, a 5 per cent. decrease in the body fat results in a 100 per cent. increase in the duration of action of a given dose of thiopentone. A breed such as the greyhound which has very little fat has an impaired ability to reduce the plasma concentration of thiopentone and narcosis may be prolonged as a result.

Comparison with Pentobarbitone

Thiopentone and pentobarbitone differ chemically only in the presence of a sulphur atom in the former in place of one of oxygen in the latter. This slight difference, however, results in marked pharmacological differences. Thiopentone is far more irritant than pentobarbitone and cannot be safely administered by routes other than by intravenous injection.

Brodie (1952) found that pentobarbitone does not become localised in any particular tissue after injection. Hermann and Wood (1952) found that in rats the duration of narcosis after injection of pentobarbitone was unaffected by the amount of body fat present. The removal of pentobarbitone from the plasma depends primarily on the rate of detoxication.

In man thiopentone is detoxicated at a rate of 10 to 15 per cent. per hour and pentobarbitone at about 4 per cent. per hour. In the dog, however, these rates are reversed, pentobarbitone being detoxicated at a faster rate than thiopentone (Brodie *et al.*, 1953).

Pentobarbitone takes longer to cross the blood-brain barrier than thiopentone (Mark *et al.*, 1955). This may be due to the lower fat solubility of pentobarbitone. The maximum depth of narcosis is not obtained with pentobarbitone until 3 to 5 minutes after injection (Wright, 1952). Thus a much slower rate of injection is necessary with pentobarbitone than with thiopentone.

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RETIREMENT OF PROFESSOR W. M. MITCHELL FROM THE R.C.V.S. COUNCIL

At the meeting of the R.C.V.S. Council, held on January 10th, the President reminded Council that this was the last meeting which would be attended as a member by Professor William Mitchell, who would be resigning when he returned to Edinburgh after the meeting. This news would be received with considerable regret by members of Council, who extended to him their sincere good wishes for complete recovery from his recent operation and were glad to know that the progress to date was satisfactory.

Professor Mitchell had rendered very great service to the country, to veterinary education, and to the profession in general, exemplified by the fact that he was not only President of the National Veterinary Medical Association, in those days, but became Principal of the College even in the same week, both of which posts he fulfilled extremely well. His many services to Council were well known.

In thanking Professor Mitchell for his past services, the President said that Council wished him and his wife a very happy retirement and would be happy indeed to see him at any Council functions in the future.

Professor Mitchell, in acknowledgment, said he had enjoyed his 12 years with the Council and would miss meeting the members from quarter to quarter. Council had a difficult job at present with its Colleges and Schools, but he felt that the changes which had been witnessed from the early days of the struggle were developing. It was, however, wise to remember that growth in the schools was continuing and it had been a difficult period because of the sudden expansion. The step which had been doubted so much at the time was now well under way, and the new schools were stimulating the old ones.

GREYHOUND WINS AFTER BONE OPERATION

Readers may have been interested to read in the newspapers recently of the victory at Stamford Bridge of Hare Spy, a greyhound with a plastic bone replacement in its right hind leg.

The veterinary surgeon who performed the operation, Mr. J. K. Bateman, hopes to provide us in due course with a clinical note. An article in *The Times* included the following:—

"It was a tricky operation," the veterinary surgeon said. The scaphoid bone in the hock had been replaced with a block of plastic—"the first time that plastic has been used to replace this particular bone in a racing dog." Steel, it was true, had been used to mend broken hocks in other greyhounds, but this was a particularly nasty break and seemed to call for another method.

Asked whether a similar operation could be performed on race-horses, for whom such an injury normally spells doom, the surgeon said that the animal's weight would seem to render such a thing impossible, but added: "I'm not an expert on horses."

Current Literature

ABSTRACTS

Transthoracic Approach to Diaphragmatic Hernia Repair in Cats and Dogs. BUTLER, H. C. (1957). *J.A.V.M.A.* **131.** 167.

Diaphragmatic ruptures in small animals are usually repaired, with the aid of a positive pressure apparatus, either through an abdominal or a lateral thoracic wound. Either technique often does not allow sufficient exposure, especially when the tear is at the costal margin, or is very large, or if it has occurred in the area of the caval foramen. A more extensive exposure is provided by a transthoracic approach in which the skin incision follows the intercostal spaces between the 7th and 8th ribs on both sides of the chest. Near the sternum the internal thoracic arteries and veins, which lie on each side lateral and parallel to the sternum between the pleura and ribs, must be ligated. The pleura is incised and the sternum cut transversely using bone forceps. Owing to the contraction of the rectus abdominis muscle the xiphoid portion of the sternum is pulled posteriorly and for this reason a retractor is not necessary. After reconstruction of the diaphragm the sternum is repaired with mattress sutures of No. 22 steel. The pleura and intercostal muscles are closed with a continuous suture and extra support is provided by 2 or 3 interrupted sutures of No. 2 catgut placed around the ribs. The usual precautions are taken against pneumothorax before the last few sutures around the rib are tied. Finally the skin wound is sutured. Post-operative care consists of confining the animal, routine nursing, and the administration of antibiotics.

L.C.V.

Correlation of Human and Animal Ringworm in West of Scotland. GENTLES, J. C., O'SULLIVAN, J. G., *et al.* (1957). *Brit. med. J.* September 21st, 1957. 678–82.

This report covers the first 2 years of work by a sub-committee appointed to investigate cases of human ringworm suspected as being of animal origin. It reports on the co-ordinated work of the medical and veterinary professions in the Glasgow and West of Scotland area in an investigation that brings up most effectively the importance of the animal reservoir of ringworm infection for human beings.

There were referred for investigation 163 cases of human ringworm infection suspected to be of animal origin. Dermatophytes were cultured from 117 (72 per cent.) of the human patients. The fungi isolated were : *T. verrucosum*, 82 ; *T. mentagrophytes*, 15 ; *M. canis*, 12 ; *T. sulphureum*, 6 ; *T. rubrum*, 1 ; *M. audouini*, 1. From 78 (48 per cent.) suspected animals cultures were obtained of : *T. verrucosum*, 71 ; *T. mentagrophytes*, 1 ; *M. canis*, 6.

On 42 (26 per cent.) occasions the same dermatophyte was cultured from the human case and the suspected animal. On 5 (3 per cent.) occasions a different zoophilic dermatophyte was isolated from each source. In 8 (5 per cent.) instances the human infection was caused by an anthropophilic fungus.

Cattle were found to form the main animal reservoir of infection in an area which embraces a very large number of stock farms. There were 78 (48 per cent.) confirmed cases of cattle to human infection. None of the human infections with *T. mentagrophytes* were found to originate from cattle.

Only 7 (4 per cent.) of human infections were traced to a small-animal source (a much lower proportion than reported by observers in other large cities).

Microsporum canis—**An Intensive Outbreak.** LAWSON, G. T. N., & MCLEOD, W. J. (1957). *Brit. med. J.* November 16th, 1957. 1159–60.

Cases of ringworm diagnosed at Belfast hospitals are notified to the medical officer of health for the area in which the patient resides. One such notification reported *Microsporum canis* infection in 3 adults, 2 dogs and a Persian kitten. The kitten was noted to be most heavily infected and as it was only recently acquired it was believed to be the source of infection. It had been obtained from a local breeder of Persian cats. Examination of the breeder's cats showed 2 tom cats affected with *M. canis*. There was also a history of kittens suffering from bald patches on the face ; sale of these kittens was deferred until the condition of the face improved. In all 10 kittens were sold during a period of slightly less than 2 months. The addresses to which the kittens were sent were obtained and in 9 instances it was possible to make complete investigations. The human contacts amounted to 42 persons ; of these 22 were found to be infected. The sex distribution was predominantly female (5 M., 17 F.) perhaps because many of the kittens were bought as pets for girls. Only one adult male was affected.

There were 9 animal contacts (7 cats, 2 dogs). The 2 dogs in one household were affected ; one cat in a household was affected and 3 out of 6 cats in a third household were affected.

Enquiry established that infection had been brought into the breeding cattery by a tom cat purchased from Leeds, where *M. canis* infection has been endemic amongst cats in recent years.

The infected animals were destroyed and no cases of child-to-child transmission were noted.

The authors stress the necessity of ascertaining and dealing with the animal reservoir as the essential factor in controlling this infection.

This outbreak gave an opportunity to confirm the incubation period as being within the range of 17 to 22 days.

G. F. B.

News and Comment

SOUNDNESS IN THE HORSE

The Technical Development committee of the B.V.A. have appointed a sub-committee to produce a handbook on the management and diseases of the horse, and it has been decided to include in this book a section on the examination of the horse for soundness.

It has been brought to the committee's notice that many types of veterinary certificates for soundness are at present in existence, and that some of these certificates are not altogether satisfactory. The committee are anxious to collect as many types of certificate as possible, with a view to drawing up a uniform wording. They would be grateful, therefore, if veterinary surgeons would assist by sending in copies of certificates for soundness in horses for consideration and comparison by the committee. These should be sent to the secretary of the Technical Development Committee, at 7, Mansfield Street, London, W.1.

VETERINARY PRACTICE BY SLEIGH

We are indebted to Captain R. N. Phillips for the following extract from a letter, sent a number of years ago, from one veterinary surgeon to another. The recent bitter weather makes the extract highly topical.

". . . Talking of bad winters, I see the papers are recalling that of 1895 which I remember well. We had snowstorm after snowstorm for nearly a week and savage frosts, and up in the hill country there were snowdrifts in places 6 or 7 feet high. On horseback was at first the only way to get anywhere and that only in the flatter country, but later the roads became frozen like iron on the surface and for 6 weeks I turned no wheel of my high gig and travelled entirely in a light sleigh which I fortunately possessed, and never have I travelled more enjoyably. Most days there was brilliant sunshine and little wind. The sleigh—the work of a local carpenter—was very light with good ground clearance, the harness was of the lightest with breast strap instead of collar, and my nippy cobs made mockery of the work as the steel skids sped over the miles to the music of a tinkling bell on their necks. It was grand while it lasted.

"Sounds quite idyllic perhaps, but journeys into the hill and mountain country were not an unmixed joy. Often we came to drifts and had to dig a passage with the spades we carried. On the Llanarmon and Llandegla moors it was pitiful to see the grouse so starved and exhausted, that one could easily have caught them: how many perished can only be surmised. I had this sleigh for many years and never missed using it when conditions were suitable, until one day a shackle holding up one of the shafts broke, letting it down to thrash the cob's leg. He promptly ran away at full gallop down the steep hill into Mold from Ruthin, hit a big stone in the gutter at the side of the road, and pitched me out into a snow bank, scared but unhurt and leaving the wreck of the sleigh behind him. The cob galloped on into the town and curiously enough, standing talking to the policeman who gallantly stopped the animal, was my father. He, recognising it, promptly hired a trap and started off on my route to pick up the possible remains he must have feared. His relief to find me all right and walking home was perhaps no more full than my own to know that the cob had not killed anyone on his mad journey.

"I put that cob into a heavy gig on a long journey in the afternoon so that he would not have time to brood over the affair, and rather to my surprise and relief he behaved beautifully which is unusual after such an experience."

UNIVERSITY NEWS

Bristol

A Congregation for the Conferment of Degrees was held on January 20th. Seven graduates were admitted to the degree of Bachelor of Veterinary Science, and Mr. P. M. Biggs, Lecturer in Veterinary Clinical Pathology, to the degree of Doctor of Philosophy. Immediately afterwards a ceremony was held to admit the new veterinary graduates to membership of the Royal College of Veterinary Surgeons.

Liverpool

Degree of B.V.Sc. Second Examination. January, 1958

PART I. VETERINARY ANATOMY (INCLUDING HISTOLOGY AND EMBRYOLOGY)

Allen W. M.; Davies, J. O.; Dawkes, B. H.; Evans, W. E. S.; Fell, C.; Gyening, E. O. (with distinction in histology); Hardy, B. D. W.; Hopkins, D. L. (with distinction in veterinary anatomy); Jones, G. W.; Jones, R. M.; Jones, R. S.; Milner, N. A. (with distinction in veterinary anatomy); Peel, D. R.; Procter, G.; Proudlove, A. J.; Rigby, J. P.; Shreeve, B. J.; Taylor, K. C.; Thomas, J. K. (with distinction in histology); Thomson, Judith A.; Vaughan, A.; Walker, D. (with distinction in veterinary anatomy); Walker, D. E.; Zagni, P. A.

PART II. PHYSIOLOGY (INCLUDING BIOCHEMISTRY)

Allen, W. M.; Davies, J. O.; Dawkes, B. H.; Evans, W. E. S.; Fell, C.; Gyening, E. O. (with distinction in biochemistry); Hardy, B. D. W.; Hopkins, D. L. (with distinction in biochemistry); Jones, G. W.; Jones, R. S.; Milner, N. A.; Peel, D. R.; Procter, G.; Rigby, J. P. (with distinction in biochemistry); Shreeve, B. J.; Taylor, K. C.; Thomas, J. K.; Vaughan, A.; Walker, D. (with distinction in biochemistry); Walker, D. E.; and Zagni, P. A.

THE ROYAL COLLEGE OF VETERINARY SURGEONS

The under-mentioned graduates were admitted to membership of the Royal College on the dates indicated:—

ASHTON, Wilfred Lionel Gwyn, School House, Talybont-on-Usk, Breconshire, January 20th, 1958, Bristol, B.V.SC. (BRIS.); BALDWIN, Basil Arthur, Thrigby Road, Filby, Gt. Yarmouth, Norfolk, January 7th, 1958, London, B.VET.MED. (LOND.); CHURCHILL, Anthony Edward, Sandringham, Walford Road, Ross-on-Wye, Herefordshire, January 7th, 1958, London, B.VET.MED. (LOND.); DAVIDSON, William Roy, Whimple Lodge, Whimple, Devon, January 7th, 1958, London, B.VET.MED. (LOND.); DYSON, Peter Travis, 27,

Lichfield Road, Stone, Staffs, January 7th, 1858, London, B.VET.MED. (LOND.); EATON, Michael Robert, 31, Fairway Crescent, Allestree, Derby, January 20th, 1958, Bristol, B.V.SC. (BRIS.); EDNEY, Andrew Thomas Bailey, 216, Canterbury Road, Sittingbourne, Kent, January 7th, 1958, London, B.VET.MED. (LOND.); EMBLETON, Gerald Anthony, 12, Brook Road, Thornton Heath, Surrey, January 7th, 1958, London, B.VET.MED. (LOND.); EZEBUIRI, Emmanuel Ogoegbulam, Umuoriehi, Umuahia, Nigeria, January 7th, 1958, London, B.VET.MED. (LOND.); FISHER, Betty Margaret (Miss), 43, Pine Grove, Totteridge, London, N.20, January 7th, 1958, London, B.VET.MED. (LOND.); GELDART, Peter Henry, 167, Berrow Road, Burnham-on-Sea, Somerset, January 20th, 1958, Bristol, B.V.SC. (BRIS.); GRIFFIN, Richard Michael, 33, Fordington Road, Highgate, London, N.6, January 7th, 1958, London, B.VET.MED. (LOND.); GRIFFITHS, Joseph David Loftus, Gateways, Hanley Swan, Worcs., January 20th, 1958, Bristol, B.V.SC. (BRIS.); HAGUE, Peter Harold, 22, Eastcourt Avenue, Earley, Reading, Berks., January 20th, 1958, Bristol, B.V.SC. (BRIS.); HARRIES, Benjamin Llewelyn, Craigfryn, Bronwydd Arms, Carmarthen, January 7th, 1958, London, B.VET.MED. (LOND.); JACKSON, Faith (Miss), Church Woods, Wonersh, Nr. Guildford, Surrey, January 7th, 1958, London, B.VET.MED. (LOND.); JONES, Willie David, Bryn Farm, Verwig, Cardigan, January 7th, 1958, London, B.VET.MED. (LOND.); KNOWLES, Robert Thomas, Park Avenue, Wisbech, Cambs., January 7th, 1958, London, B.VET.MED. (LOND.); MACLEOD, Norman Simon Macnicol, 145, Melbourne Avenue, Mount Blow, Dalmuir, Glasgow, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); MANN, Peter George Hubert, Belmont, Cross Elms Lane, Stoke Bishop, Bristol, 9, January 7th, 1958, London, B.VET.MED. (LOND.); MARTIN, Charles Anthony Wyndham, Hilldene, Sandygate, Wath-cn-Dearne, Rotherham, Yorks, January 7th, 1958, London, B.VET.MED. (LOND.); MILLETT, John Douglas, The Beehive, London Road, Dorking, Surrey, January 7th, 1958, London, B.VET.MED. (LOND.); PETERS, Ian Thomson, 129, Dumbuck Crescent, Dumbarton, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); POTT, John Malcolm, 67, Aire Street, Goole, Yorks, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); RANDLESOME, Anthony George Charles, 107, Sheaveshill Avenue, Colindale, London, N.W.9, January 7th, 1958, London, B.VET.MED. (LOND.); ROBERTS, David Hughes, Bryn Awel, High Street, Rhuddlan, Rhyl, Flints, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); RODGERS, Samuel Edgar, Westgarth, Old Whittington, Chesterfield, Derbyshire, January 7th, 1958, London, B.VET.MED. (LOND.); RUSSELL, Joseph Steven, 48, Whistleberry Crescent, Whitehall, Hamilton, Lanarks., January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); RUTTY, Donald Arthur, 20, Baker Street, Sparkhill, Birmingham, 11, January 7th, 1958, London, B.VET.MED. (LOND.); SOMMERVILLE, Barbara Ann (Miss), 41, The Leys, Woburn Sands, Nr. Bletchley, Bucks., January 20th, 1958, Bristol, B.V.SC. (BRIS.); SYKES, Kenneth Chadwick, 458, Holden Road, Leigh, Lancs., January 7th, 1958, London, B.VET.MED. (LOND.); TAYLOR, John Michael, The King's Arms, Bishopric, Horsham, Sussex, January 7th, 1958, London, B.VET.MED. (LOND.); THOMSON, James Geddes, 63, Polwarth Gardens, Hyndland, Glasgow, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); THORNTON, David Alexander Kennedy, Lisnanagh, Forest Row, Sussex, January 7th, 1958, London, B.VET.MED. (LOND.); TURNER, William Trevor, 15, Mandeville Road, Northolt, Greenford, Middx., January 7th, 1958, London, B.VET.MED. (LOND.); WILLS, Peter Dryden, Westfield, Cassalands, Dumfries, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.); WILSON, George William Charles, Wayside Farm, Ravensden, Bedford, January 20th, 1958, Bristol, B.V.SC. (BRIS.); WILSON, Robert, 1, Morrison Street, Kirriemuir, Angus, January 11th, 1958, Glasgow, B.V.M.S. (GLAS.).

R.C.V.S. OBITUARY

We record with regret the death of the following member of the profession:—

MORCOS, Zaki, F.R.C.V.S., M.V.SC., D.V.H., Director, Coptic Hospital Laboratory, 5, Rue Mehalla, Heliopolis, Cairo, Egypt. Graduated July 11th, 1925, at Liverpool. Died January 2nd, 1958.

PERSONAL

Births

BRADLEY.—On January 19th, 1958, at Delos Cottage, Parkstone, to Marguerita, wife of John F. Bradley, M.R.C.V.S., a fourth son.

GRAY.—On January 16th, 1958, at the Royal Bucks Hospital, to Anne, wife of John Gray, M.R.C.V.S., Aylesbury, a son, Thomas Matthew, brother for Jan and Simon.

GRAVES.—On January 18th, 1958, to Joan, wife of John A. Graves, B.SC., M.R.C.V.S., D.V.S.M., of Wiveliscombe, Somerset, a daughter, Caroline Elizabeth, sister for Barry and Sally.

RICHARDSON.—On January 2nd, 1958, to Betty, wife of R. Richardson, B.SC., M.R.C.V.S., of 91, Newbold Road, Chesterfield, a daughter, Helen Maura, sister for Anne.

WOODALL.—On January 25th, 1958, to Barbara, wife of Harold Woodall, M.R.C.V.S., of Marlborough, Wilts, a daughter, Nicola Gillian.

Engagement

BRADLEY—ELLIOTT.—The engagement is announced between John Edwin Bradley, B.V.M.S., M.R.C.V.S., only son of Mr. and Mrs. Bradley of Durham, and Jean Elliott, only daughter of Mr. and Mrs. G. W. Elliott of Whitley Bay, Northumberland.

COMING EVENTS

February

5th (Wed.). General Meeting of the Midland Counties Veterinary Association at the Birmingham Medical Institute, 36, Harborne Road, Birmingham, 15, 2.45 p.m.

Meeting of the Lancashire Veterinary Association in the University Veterinary Hospital, Liverpool, 2.30 p.m.

6th (Thurs.). General Meeting of the Central Veterinary Society at the Royal Veterinary College, Camden Town, N.W.1, 6 p.m.

7th (Fri.). Annual Ball of the Royal (Dick) School of Veterinary Studies in the Assembly Rooms, George Street, Edinburgh, 9 p.m.

Annual Ball of the Glasgow University Veterinary Medical Association in the Rhul, Sauchiehall Street, Glasgow, 8 p.m.

12th (Wed.) Meeting of the West of Scotland Division at the University School of Veterinary Science, Garscube, Bearsden, Glasgow, 2.30 p.m.

Meeting of the R.A.V.C. Division at the Central Veterinary Laboratory, New Haw, Weybridge, Surrey, 2.15 p.m.

13th (Thurs.). Spring Meeting of the Dumfries and Galloway Division in the Crown and Mitre Hotel, Carlisle, 2.15 p.m.

14th (Fri.). General Meeting of the Society for the Study of Animal Breeding at the B.V.A., 7, Mansfield Street, Portland Place, London, W.1, 11 a.m.

Joint Meeting of the Society of Practising Veterinary Surgeons and the Shropshire Veterinary Club at the Radbrook Hall Hotel, Shrewsbury, 7.30 p.m.

General Meeting of the Society of Practising Veterinary Surgeons in the Radbrook Hall Hotel, Shrewsbury, 8 p.m.

19th (Wed.). Meeting of the Section of Comparative Medicine, Royal Society of Medicine, at the Society's House, 5 p.m.

20th (Thurs.). Ordinary Meeting of the Ayrshire Veterinary Association in the Ailsa Lounge, Ayr Station Hotel, 2.30 p.m.

General Meeting of the Herts and Beds Veterinary Association at 70, Holywell Hill, St. Albans, 7.30 p.m.

21st (Fri.). Annual Ball of the Liverpool University Veterinary Society in the Students' Union, 8 p.m.

26th (Wed.) Ordinary General Meeting of the Southern Counties Veterinary Society at the Polygon Hotel, Southampton, 7 p.m.

27th (Thurs.). Meeting of the Essex Veterinary Society at the Essex Institute of Agriculture, Writtle, Essex, 7.30 p.m.

FOOT-AND-MOUTH DISEASE

The areas described in the schedules below are declared to be Infected Areas for the purpose of preventing the spread of foot-and-mouth disease:—

IN THE COUNTY OF WEST SUSSEX

The Petty Sessional Division of Midhurst.

In the Petty Sessional Division of Petworth: The parishes of Lurgashall, Northchapel, Plaistow, Loxwood, Wisborough Green, Kirdford, Tillington, Petworth, Fittleworth, East Lavington, Duncton, Barlavington, and Sutton.

In the Petty Sessional Division of Chichester: The parishes of Marden, West Dean, Singleton, East Dean and Upwaltham.

IN THE COUNTY OF SURREY

In the Petty Sessional Division of Godalming: The parishes of Haslemere, Thursley, Peper Harow, Witley, Chiddingfold, Hambledon, Hascombe, Dunsfold and Alfold.

In the Petty Sessional Division of Farnham: The parishes of Tilford, Elstead, Frensham, Dockenfield and Hindhead and Churt.

IN THE COUNTY OF SOUTHAMPTON (HAMPSHIRE)

In the Petty Sessional Division of Alton: The parishes of Selborne, Kingsley, Headley, Whitehill and Grayshott, and so much of the parish of Newton Valence as lies to the south and east of the road running from East Tisted to Selborne, including the said road.

In the Petty Sessional Division of Petersfield: The parishes of Hawkley, Greatham, Bramshott, Liss, Steep, Petersfield and Buriton.

IN THE COUNTY OF SOMERSET

The Petty Sessional Division of Frome.

In the Petty Sessional Division of Weston: The parishes of Southstoke, Monkton Combe, Freshford, Hinton Charterhouse, Combe Hay, Wellow, Shoscombe and Peasedown St. John, and so much of the parish of Camerton as lies to the south and east of the main road running from Radstock to Bath, including the said road.

In the Petty Sessional Division of Kilmersdon: The parishes of Hemington, Coleford, Holcombe and Kilmersdon, and so much of the parishes of Stratton on the Fosse and Norton-Radstock as lies to the south and east of the main road running from Shepton Mallet *via* Radstock to Bath, including the said road.

In the Petty Sessional Division of Shepton Mallet: The parishes of Stoke St. Michael, Downhead, Cranmore, Batcombe and Upton Noble and so much of the parish of Doulting as lies to the north of the railway line running from Shepton Mallet to West Cranmore, excluding the said railway.

So much of the parish of Shepton Mallet as lies to the east of the road running from Oakhill *via* Downside, the level crossing and Cannard's Grave to Prestleigh, including the said road.

In the Petty Sessional Division of Wincanton: The parish of Brewham.

IN THE COUNTY OF WILTS

The Petty Sessional Divisions of Trowbridge and Westbury.

In the Petty Sessional Division of Bradford: The parishes of Limpley Stoke, Winsley, Westwood, Bradford-on-Avon, Holt and Wingfield, and so much of the parish of South Wraxall as lies to the south and east of the road running from Bradford-on-Avon *via* Bradford Leigh to Great Chalfield, including the said road.

In the Petty Sessional Division of Melksham: The parish of Semington.

In the Petty Sessional Division of Whorwellsdown: The parishes of Hinton, Keevil, Steeple Ashton, West Ashton, Edington and East Coulston.

In the Petty Sessional Division of Devizes: The parishes of Erlestoke and Cheverell Magna.

In the Petty Sessional Division of Warminster: The parishes of Corsley, Upton Scudamore, Warminster, Bishopstrow, Norton Bavant, Heytesbury, Knook, Imber, Upton Lovell, Horningsham, Longbridge Deverill, Sutton Veny, Boyton, Maiden Bradley with Yarnfield, Kingston Deverill and Brixton Deverill.

In the Petty Sessional Division of Tisbury and Mere: The parishes of Kilmington, Stourton with Gasper, Zeals, Mere, West Knoyle, East Knoyle, Sedgehill, Hindon, Chicklade and Berwick St. Leonard.

The Borough of Wilton.

In the Petty Sessional Division of Salisbury and Amesbury: The parishes of Fovant, Compton Chamberlayne, Burcombe Without, South Newton, Woodford, Wilsford cum Lake, Winterbourne Stoke, Shrewton, Orcheston, Berwick St. James, Steeple Langford, Stapleford, Great Wishford, Barton St. Martin and Dinton, and so much of the parishes of Amesbury and Durrington as lies to the west of the main road running from Salisbury *via* Amesbury to Enford, excluding the said road.

In the Petty Sessional Division of Everley and Pewsey: The parishes of Wilsford and Charlton, and so much of the parishes of Figheldean, Netheravon, Enford, Upavon and Rushall as lies to the west of the main road running from Amesbury *via* Enford and Upavon to Pewsey, excluding the said road.

In the Petty Sessional Division of Devizes: The parishes of Tilshead, West Lavington, Cheverell Parva, Market Lavington, Easterton, Urchfont, Chirton and Marden.

In the Petty Sessional Division of Warminster: The parishes of Chitterne, Codford, Sherrington, Stockton and Wylye.

In the Petty Sessional Division of Tisbury and Mere: The parishes of Semley, West Tisbury, Tisbury, Swallowcliffe, Sutton Mandeville, Teffont, Chilmark, Fonthill Bishop and Fonthill Gifford.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Angus. South Powrie Farm, Murroes, Dundee (Jan. 25).

Fowl Pest

Cambs. Rossendale, White Cross Road, Wilburton, Ely; 3, The Borough, Aldreth, Haddenham, Ely; Miss Russell's Land, Aldreth, Haddenham, Ely (Jan. 21); The Poplars, West Street, Over (Jan. 22).

Hunts. Glebe House, Church Street, Fenstanton, Huntingdon (Jan. 20).

Lancs. Ivy Farm, Thistleton, Preston; 36, Moss Road, Birkdale, Southport; 151, Guildford Road, Birkdale, Southport (Jan. 20); Annsdale, Coote Lane, Whitestakes, Preston; Greaves Moss Farm, Birkdale, Southport; Southview, Marsh Lane, Longton, Preston (Jan. 21); Spine Cop Farm, Coote Lane, Whitestakes (Jan. 22); Brick House Farm, Elmers Green, Dalton, Parbold, Wigan; Chapel House Farm, School Lane, Skelmersdale, Ormskirk (Jan. 26).

Norfolk. Malkin Farm, Kerdeston, Reepham, Norwich; Westgate Street, Shouldham, King's Lynn (Jan. 21); Westgate Street, Shouldham, King's Lynn (Jan. 25).

Yorks. Garden House, Welbury, Northallerton (Jan. 25); The Laurels, Welbury, Northallerton (Jan. 26).

Swine Fever

Anglesey. Hendre Boeth, Llaniestyn, Llangoed, Beumaris (Jan. 21).

Beds. School Farm, Clophill Road, Maulden; Glenmoor, New Road, Clifton, Shefford (Jan. 20); Struttle End, Ravensden; Wrayfields Farm, Stotfold, Arlesey (Jan. 22); Green Farm, Bedford Road, Barton-in-the-Clay (Jan. 24).

Berks. Westbrook Farm, Boxford, Newbury (Jan. 20).

Ches. Winterford Farm, Rushton, Tarporley (Jan. 20).

Derby. Pipehay Farm, Pipehay Lane, Draycott-in-the-Clay (Jan. 21).

Devon. Village Farm, Holne, Newton Abbot; Littlecombe Farmstead, Holne, Newton Abbot (Jan. 24).

Glam. Lower Pentwyn Cottage, Marshfield, Cardiff (Jan. 23).

Hants. Twiggs Lane Cottage, Twiggs Lane, Marchwood, Southampton (Jan. 20); Cold Harbour Farm, Wickham, Fareham (Jan. 21); Lions Hill Farm, Ashley Heath, Ringwood (Jan. 22).

Herts. Bury Farm, Kimpton, Hitchin (Jan. 23); Lords Farm, Aston End, Stevenage (Jan. 24).

Norfolk. Pearces Farm, Blo' Norton Road, South Lopham, Diss (Jan. 22).

Leics. Manor Farm, Aston Flamville, Hinckley (Jan. 21).

Somerset. Woodside Farm, Sparkford, Yeovil (Jan. 22).

Suffolk. Gate Farm, Depden, Bury St. Edmunds (Jan. 20); Honeypot Farm, Wortham, Diss (Jan. 23).

Sussex. West Barnham Fruit Farm, Barnham, Bognor Regis (Jan. 22).

Warwicks. Dunkley Farm, Cawston Lane, Dunchurch, Rugby; Hill Farm, Hatton (Jan. 20); Turkey Farm, and Piggeries at Beausale Lane, Hatton (Jan. 22).

Wilts. Manor Farm, Teffont, Salisbury (Jan. 23).

Worcs. Bradley Farm, Bradley Green, Redditch; Wordsley Hospital, Wordsley, Stourbridge (Jan. 23).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

A Highly Infectious Disease of Pigs in East Anglia

Sir,—In November, 1957, we encountered an unusual outbreak of enteritis in a large herd of pigs in East Anglia. The disease was afebrile but extremely infectious, and by the end of the outbreak nearly all the animals in the herd had scoured for several days. Piglets of about 3 weeks of age and upwards generally recovered, but there was high mortality among the younger animals. The infection was transmitted very readily by direct and indirect contact to our experimental pigs and once more proved fatal to very young animals. Subsequently, it has been reproduced with the supernatant fluid from a centrifuged suspension of brain and intestinal contents taken from naturally-occurring cases. This inoculum was bacteriologically sterile.

We have now investigated 5 outbreaks in the field. All these have been clinically and pathologically similar and a total of about 60 litters have so far been affected. In nearly half of the litters losses have been severe.

The most characteristic *post-mortem* finding in piglets dying of the disease has been an acute gastritis, which has generally been haemorrhagic and often ulcerative. There has also been an enteritis, varying in degree from haemorrhagic to catarrhal. Another common finding has been acute meningeal congestion, sometimes with haemorrhages. Other less-constant lesions have included multiple petechial haemorrhages, especially in the kidney, lymph nodes, and larynx. Occasionally, infarcts have been present in the spleen.

It is noteworthy that the disease affects pigs that have been vaccinated against swine fever. Furthermore, the mortality has been no greater in unvaccinated herds than in vaccinated ones. However, since this disease has some features in common with swine fever, pancreases from a number of dead animals have been sent to the Central Veterinary Laboratory, Weybridge, for the gel-diffusion precipitin test. These tests have been consistently negative.

Work is in progress on several aspects of this condition and a fuller account will be published when transmission experiments using filtered material are completed. But, as these present oubreaks are very similar to the serious epizootic Transmissible Gastroenteritis in the United States, the purpose of this letter is to draw attention to an entity that could likewise become a serious problem in Britain.

Yours faithfully,

R. F. W. GOODWIN,
A. R. JENNINGS.

School of Veterinary Medicine,
University of Cambridge.

January 27th, 1958.

The " Space Dog "

Sir,—I wanted to keep out of this correspondence because it seems too psychologically " loaded " to be properly handled in a professional journal; but the surprising disclosure that there are British veterinary surgeons who will act as apologists for those who indulge in unpardonable cruelty has broken down my resolution, especially as these apologists appear to be deluded as to the motives which have inspired world-wide revulsion.

There is nothing particularly anti-Russian about those people who have compassion for this latest victim of the scientists. Wherever there are men and women the majority will have a hatred of cruelty and a love of liberty; and if cruelty is practised or liberty suppressed, no matter on what pretext, be it scientific, religious, military, or political, there will be found men and women with the spirit to protest. Let us thank God that in our country it does not take any particular courage to stand up and say what is on one's mind. In fact we were urged explicitly to do so by our Sovereign in her Christmas message. This is far from being the case in many other countries where freedom of speech is a longed-for luxury.

Major Hamilton Kirk, far from being anti-Russian, pointed out that the thousand million or so pounds which were spent in launching the two sputniks would have been better employed in providing adequate housing. There is no " sour grapes " about our attitude. Of course we are all excited about the prospect of reaching for the stars; but why spoil it with cruelty? No, the dog in the sputnik is bad science in the same way that Pavlov's psychology is bad science, and one is afraid it may lead to similar bad results.

There seems to be a similarity between this situation and that of Ann Frank in the Amsterdam garret.

Yours faithfully,
F. B. EDWARDS.

Newgate,
Llanbrynmair,
Mont.

January 11*th*, 1958.

Muscle Relaxants

Sir,—In your issue of January 11th Dr. R. F. Montgomerie announced the intention of Messrs. Burroughs Wellcome & Co. to sell succinylcholine chloride under the trade name Midarine. I can obtain no assurance from Dr. Montgomerie's letter that *the sale and use* of the drug will be restricted to members of the veterinary and medical professions; neither am I aware of any means of securing such restrictions other than by scheduling it under the Dangerous Drugs Act.

In your issue of January 4th, Mr. P. M. Keen, B.V.SC., M.R.C.V.S., drew attention to some of the disadvantages of succinylcholine; Dr. Montgomerie disagrees with Mr. Keen and assures us that " properly applied, and no great level of professional acumen and skill is required in this, succinylcholine chloride can indeed provide the veterinary surgeon in practice with a method of avoiding much of the physical risk and mental torture associated with the accepted methods of casting the horse." Has Dr. Montgomerie some hitherto unpublished means of *knowing*, not assuming, the animal's sensations? Of course, he knows no more than I do; and I find the greatest difficulty in knowing my own sensations, let alone any other person's or animal's. It is the most difficult task before any physician of man or animal.

Succinylcholine paralyses the nerve endings in the muscles; it has no sedative, narcotic, or anaesthetic effect. Like curare, it is a poison. To call it a poison has no influence to-day in Parliament and the country. A Minister of Agriculture, through his Pests Control Division, is the modern Borgia of poisons.

Should succinylcholine be brought under the Dangerous Drugs Act, which makes *possession* of a scheduled drug an offence? Unless it is so scheduled Dr. Montgomerie's announcement of its impending sale will be welcomed by the doping gentry of the racing world. From a long experience of investigating their methods I suspect they will find succinylcholine a useful addition to their art and a devilish difficulty for the likes of

Yours faithfully,
TOM HARE.

529a, Finchley Road,
London, N.W.3.

January 14*th*, 1958.

Sir,—I must apologise if my letter in your issue of January 4th has been construed by Dr. Montgomerie as questioning in any way the work done at his laboratories on muscle relaxants, or the usefulness of these drugs. I intended solely to question the possible abuse of the drug under practical conditions.

I am relieved that Dr. Montgomerie's experience satisfies him that the use of the drug *per se* is more humane than the " mental torture " of more normal casting methods—although it must be difficult to draw a parallel between the reactions of a voluntary human subject and those of the horse.

My chief anxiety, hardly touched upon by Dr. Montgomerie, is of the pain which may be inflicted once the horse is cast. Surely as long as the maker's " specific recommendations " include any use without general anaesthesia there is a grave risk of the " unthinking abuse " which Dr. Montgomerie mentions?

I look forward to reading the forthcoming account of his work on these substances and trust this will further dispel my doubts.

Yours faithfully,
P. M. KEEN.

65-67, Grenfell Road,
Maidenhead,
Berks.

January 12*th*, 1958.